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FIG. 1

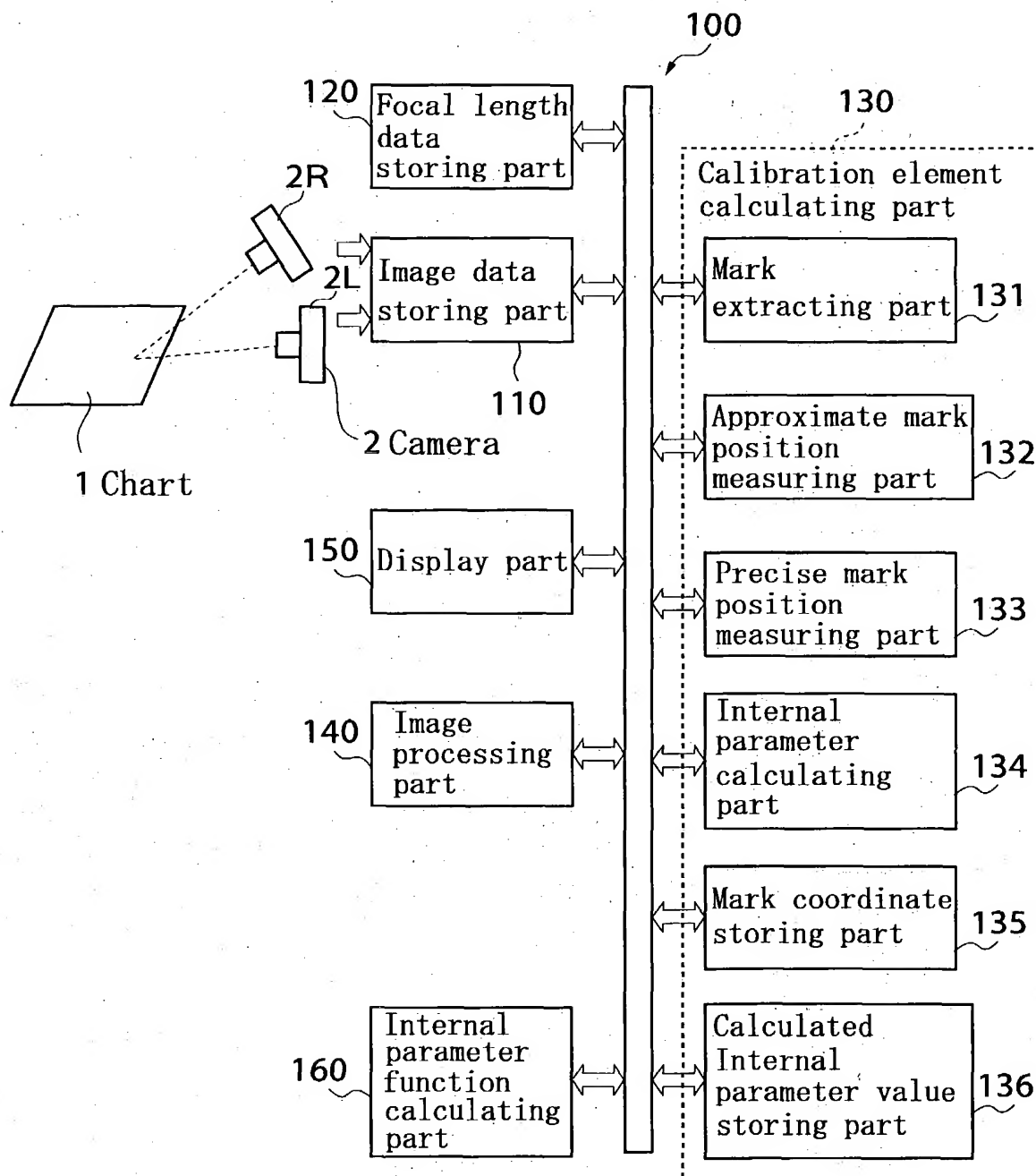
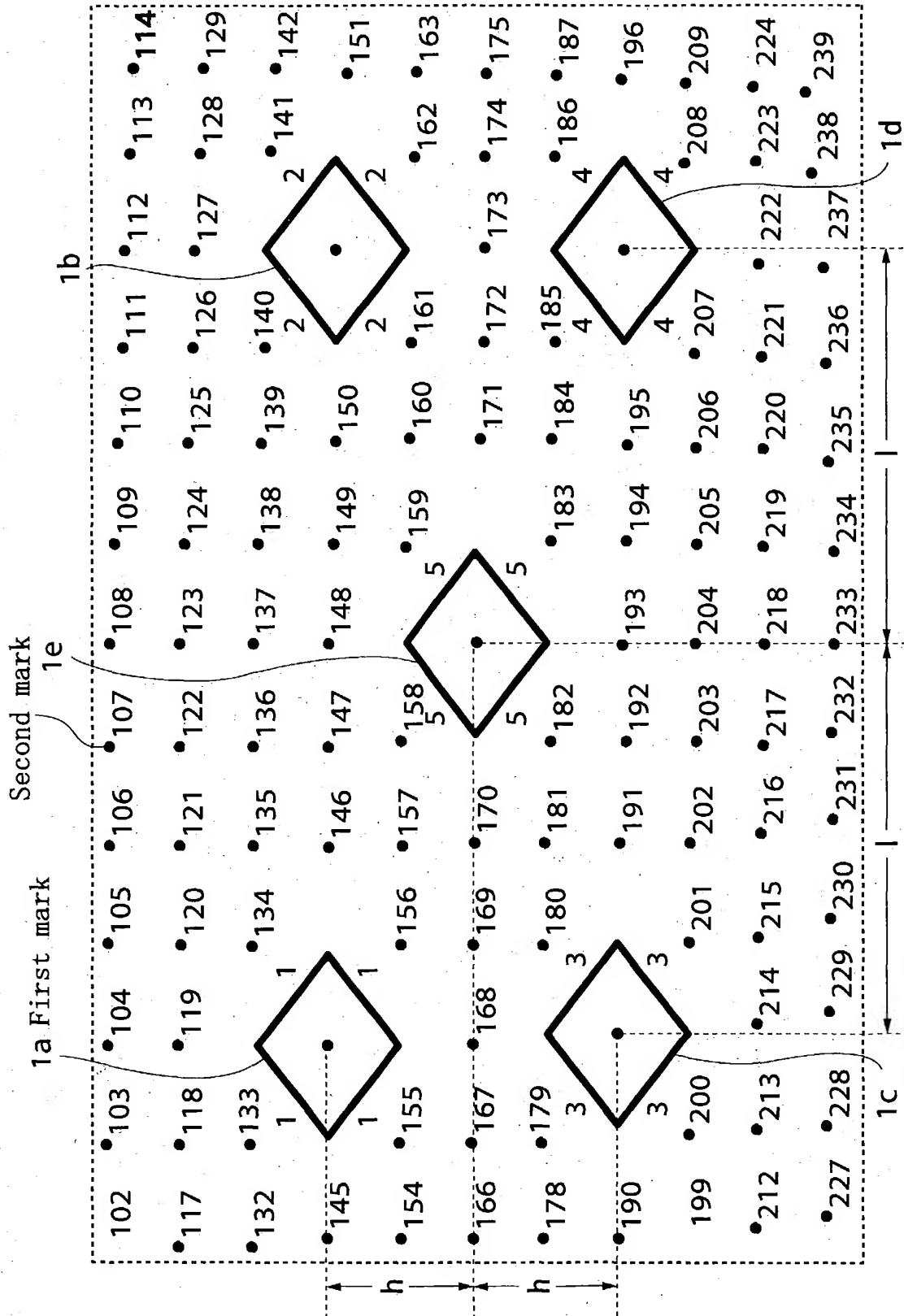


FIG. 2



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FIG. 3(A)

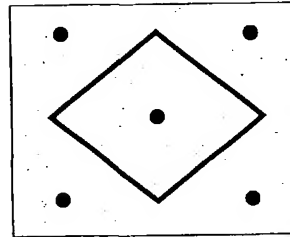


FIG. 3(B)

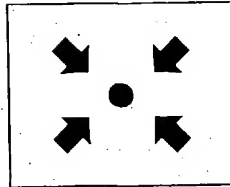
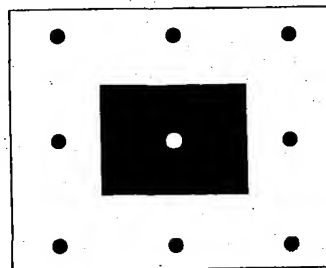


FIG. 3(C)



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Second mark



FIG. 4(A)



FIG. 4(B)



FIG. 4(C)



FIG. 4(D)



FIG. 4(E)



FIG. 4(F)



FIG. 4(G)



FIG. 4(H)

.....

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FIG. 5

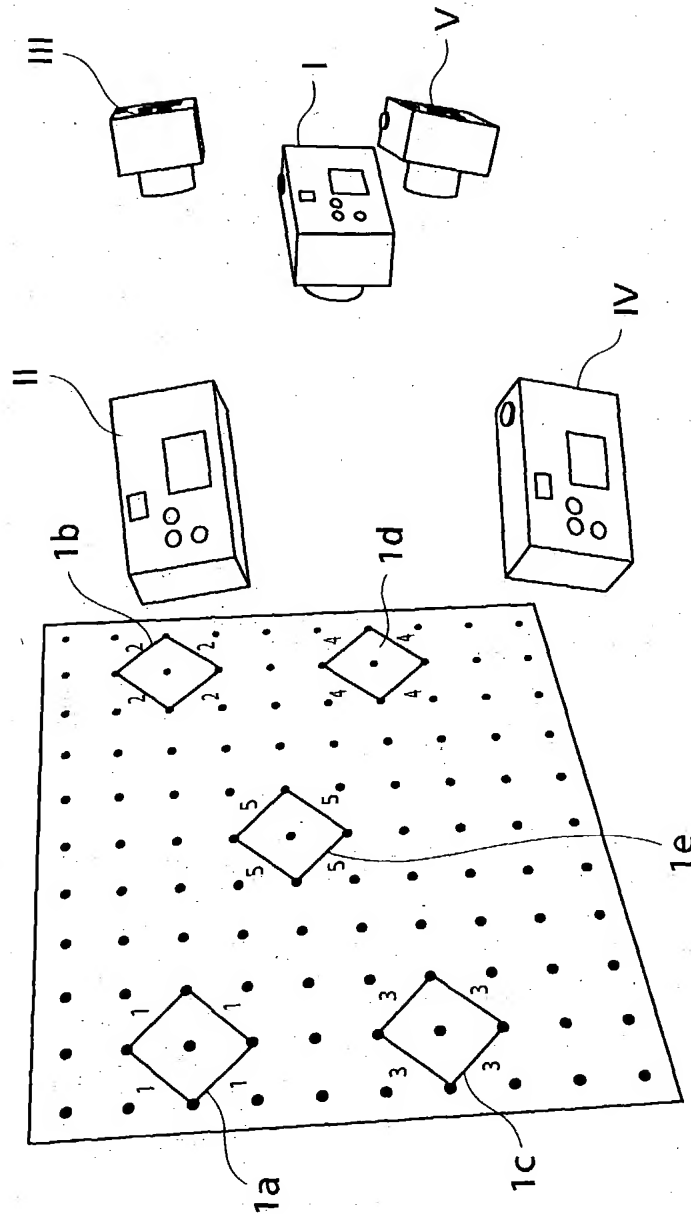


FIG. 6(A)

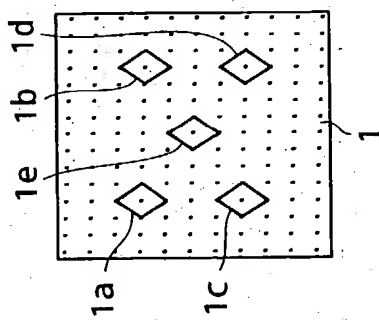


FIG. 6(B)

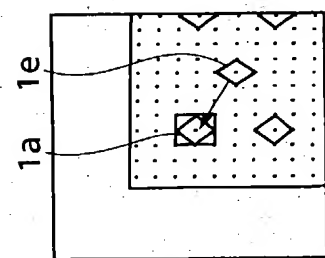


FIG. 6(C)

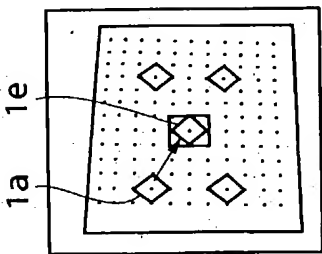


FIG. 6(D)

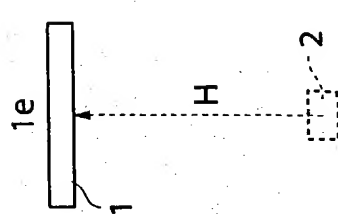
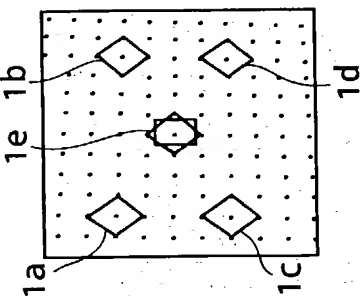


FIG. 6(E)

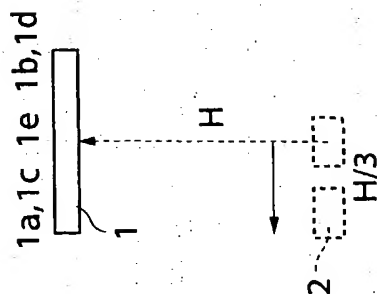


FIG. 6(F)

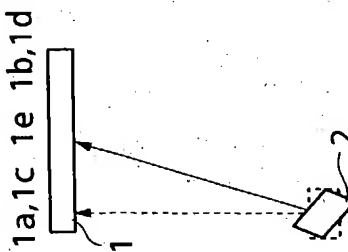


FIG. 6(G)

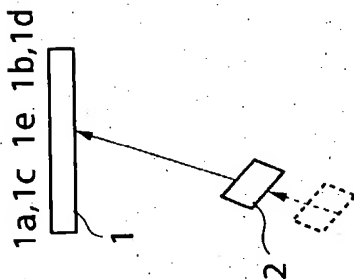
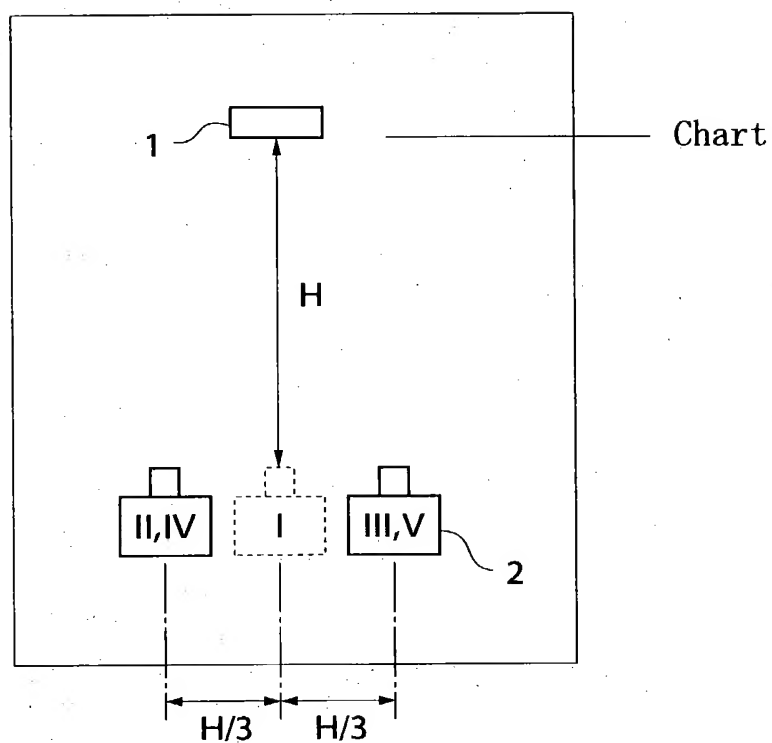


FIG. 6(H)

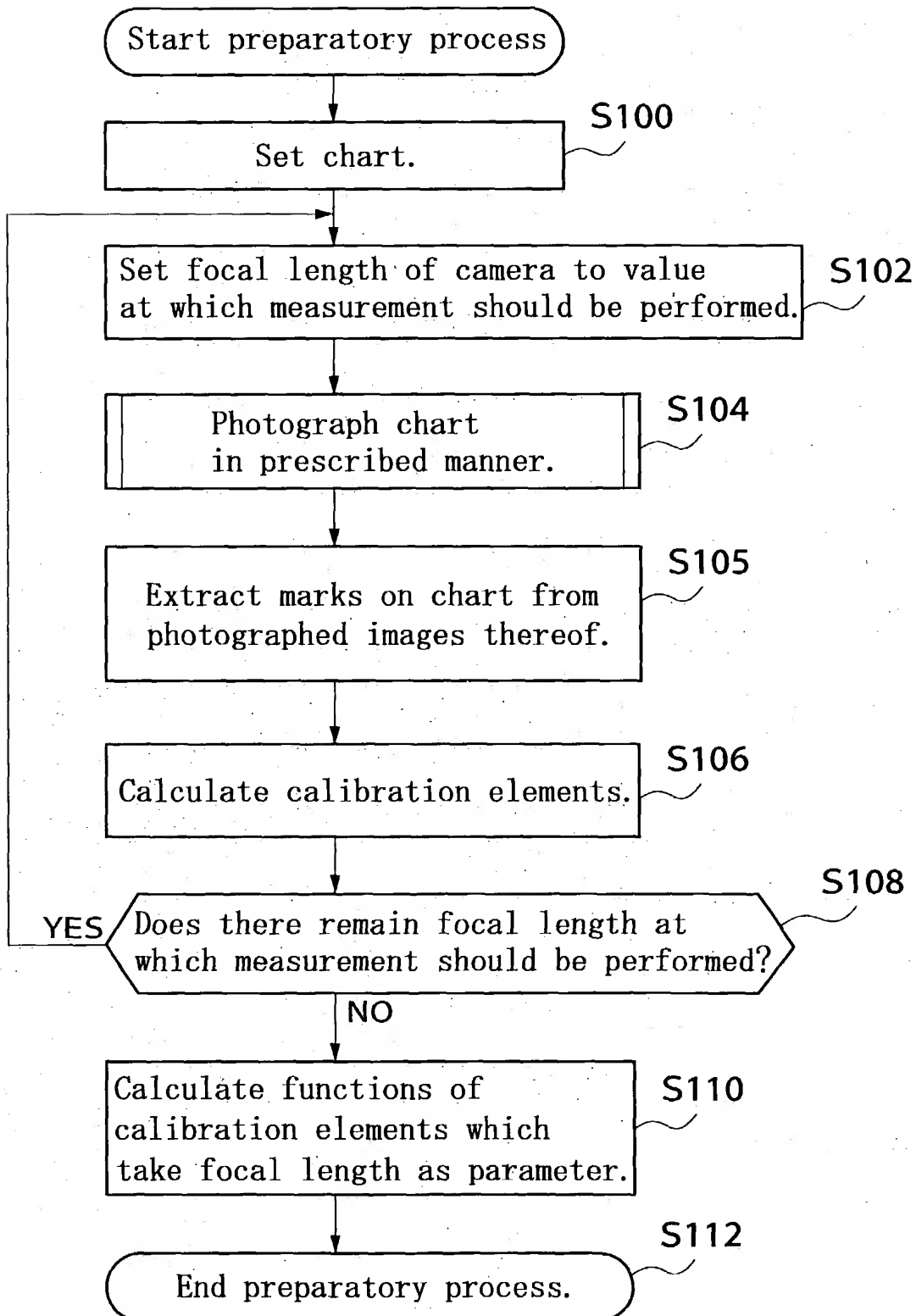
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FIG. 7



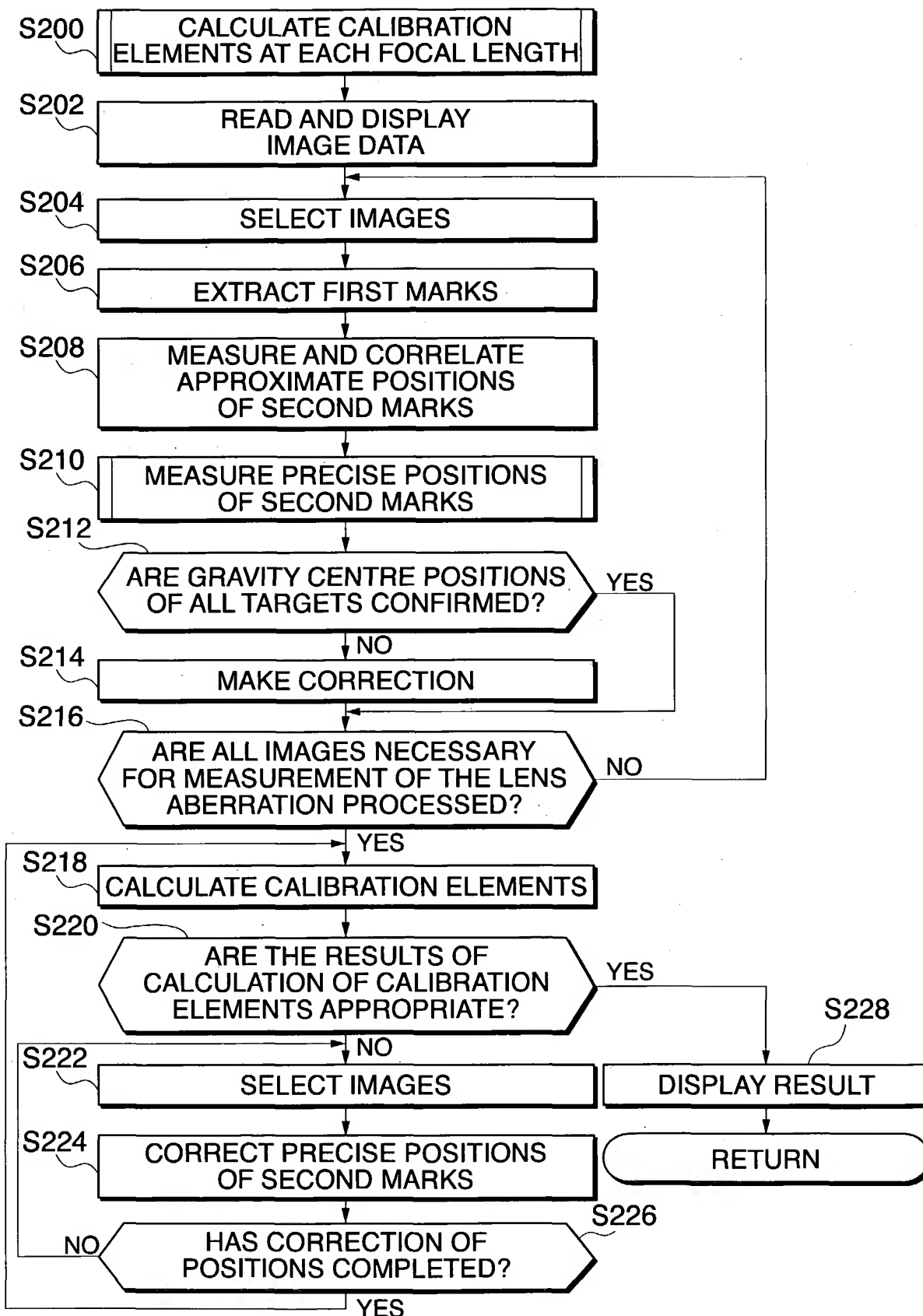
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FIG. 8



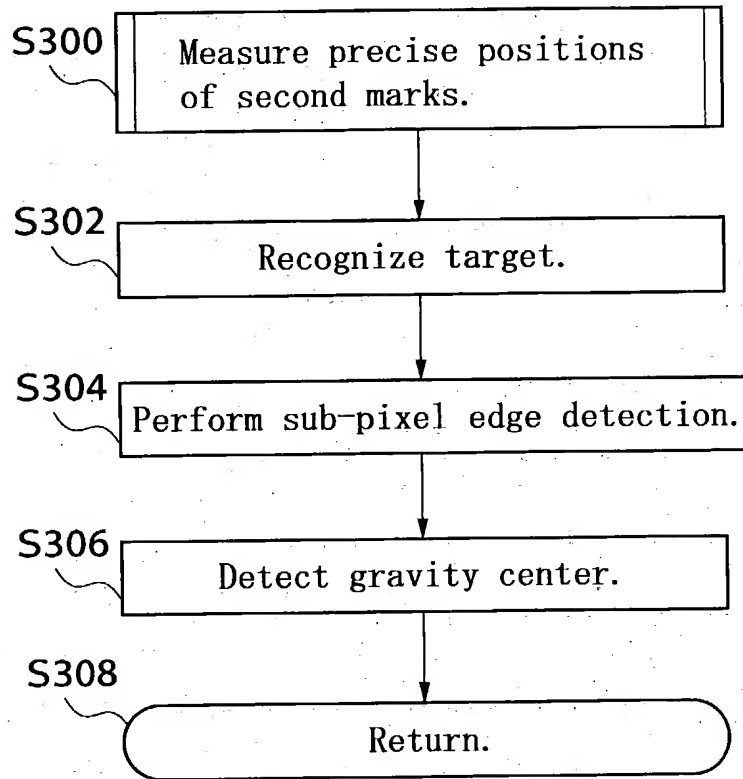
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FIG. 9



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FIG. 10



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FIG. 11(A)

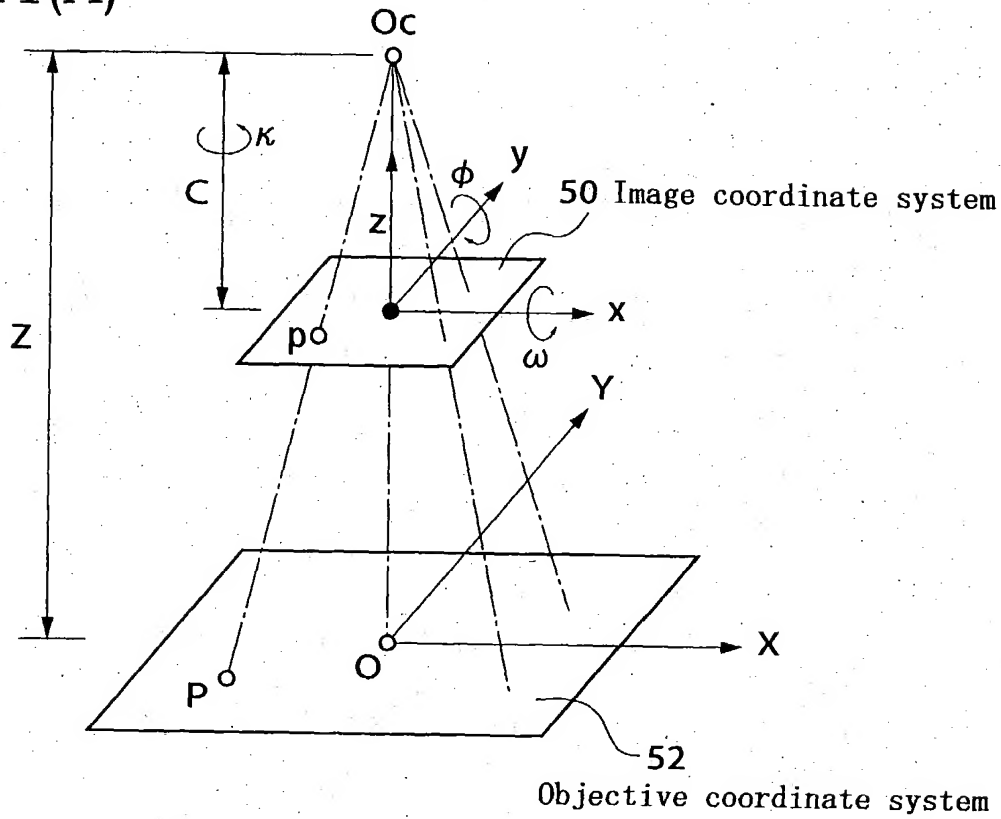
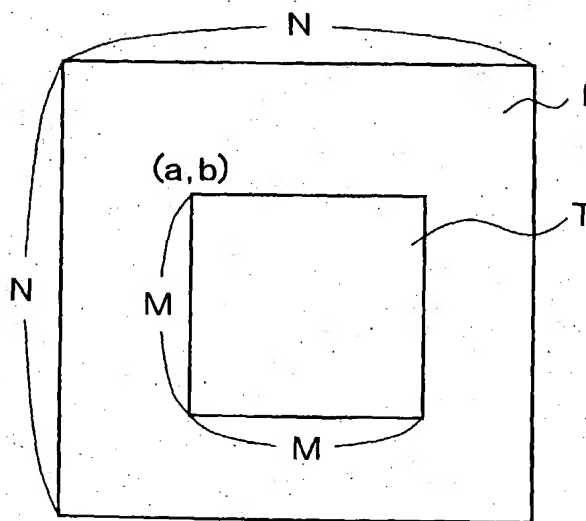


FIG. 11(B)



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FIG. 12

cmr file

Display analysis result

Display another cmr file

OK

Distortion display magnification 8

142 BEFORE CORRECTION

144 AFTER CORRECTION

146 IDEAL

☒ Tetragonal grid (white lines)
 ☒ Distortion before correction (red lines)
 ☒ Distortion after correction (black lines)

Maximum value of the distortion before correction.

417.33 [um] 35.367 [Pixels]

Maximum value of the distortion after correction.

26.141 [um] 2.2153 [Pixels]

Camera parameters

Focal length

18.476568 [mm]

Principle point position

11.901347 [mm]

Principle point position Y

7.941338 [mm]

Correction model

☒ Include distortion aberration in the radial direction only.
 ☐ Include distortion aberration in the radial direction and tangential directions.

Distortion parameters

Parameter 1

0.0002367945

Parameter 2

-5.173634e-007

Parameter 3

-3.367616e-010

Parameter 4

2.997973e-012

Image resolution Xr

11.8 [um]

Image resolution Yr

11.8 [um]

FIG. 13(A)

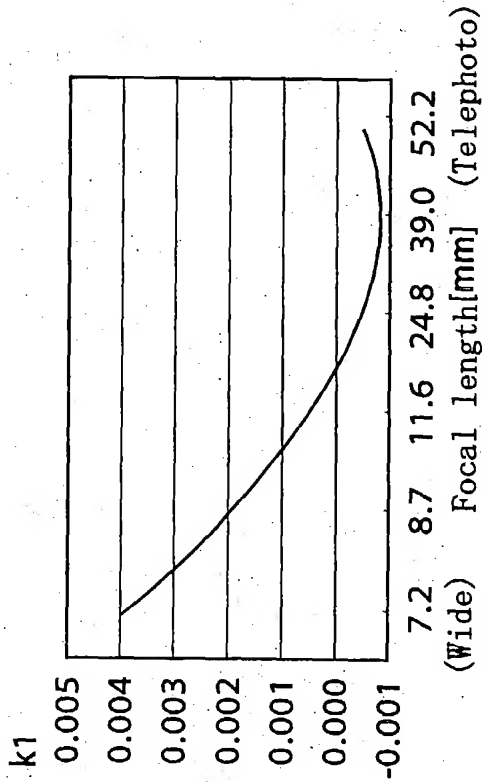
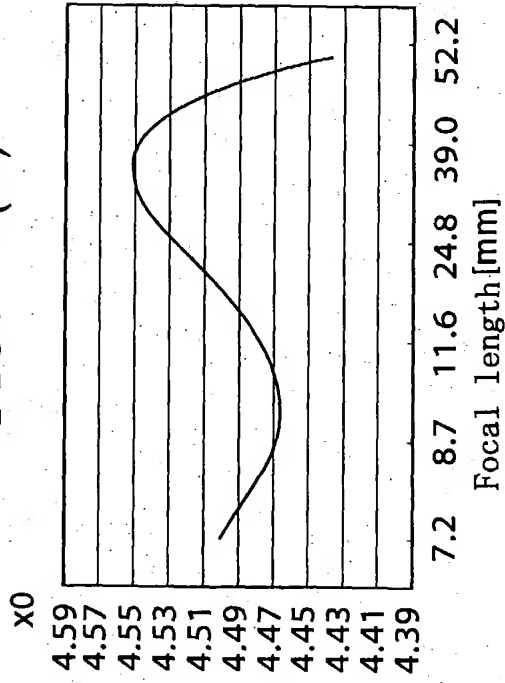


FIG. 13(C)



k_2

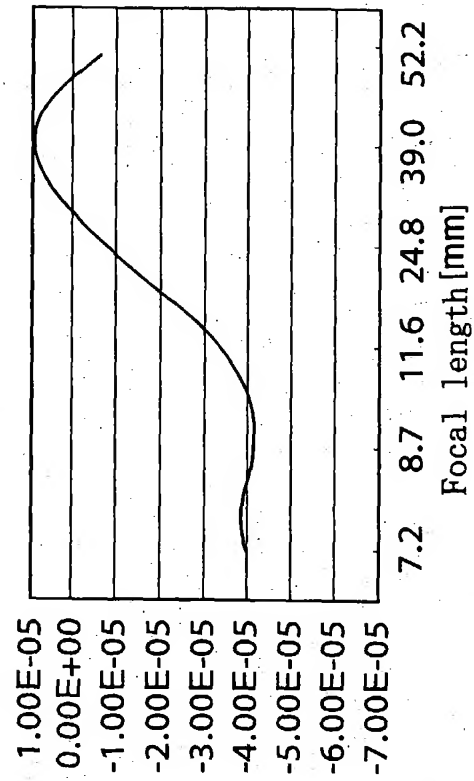


FIG. 13(B)

y_0

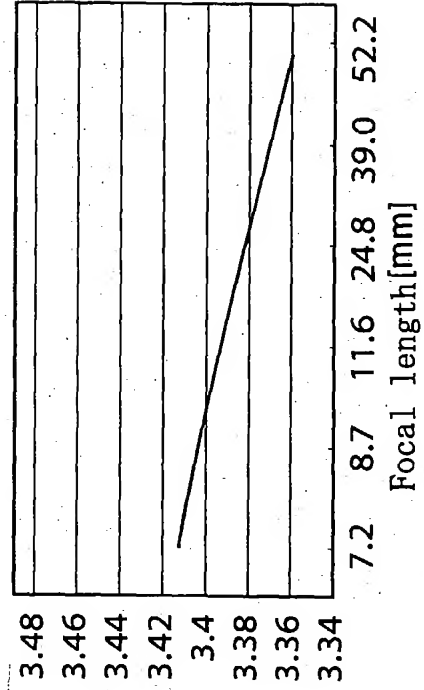
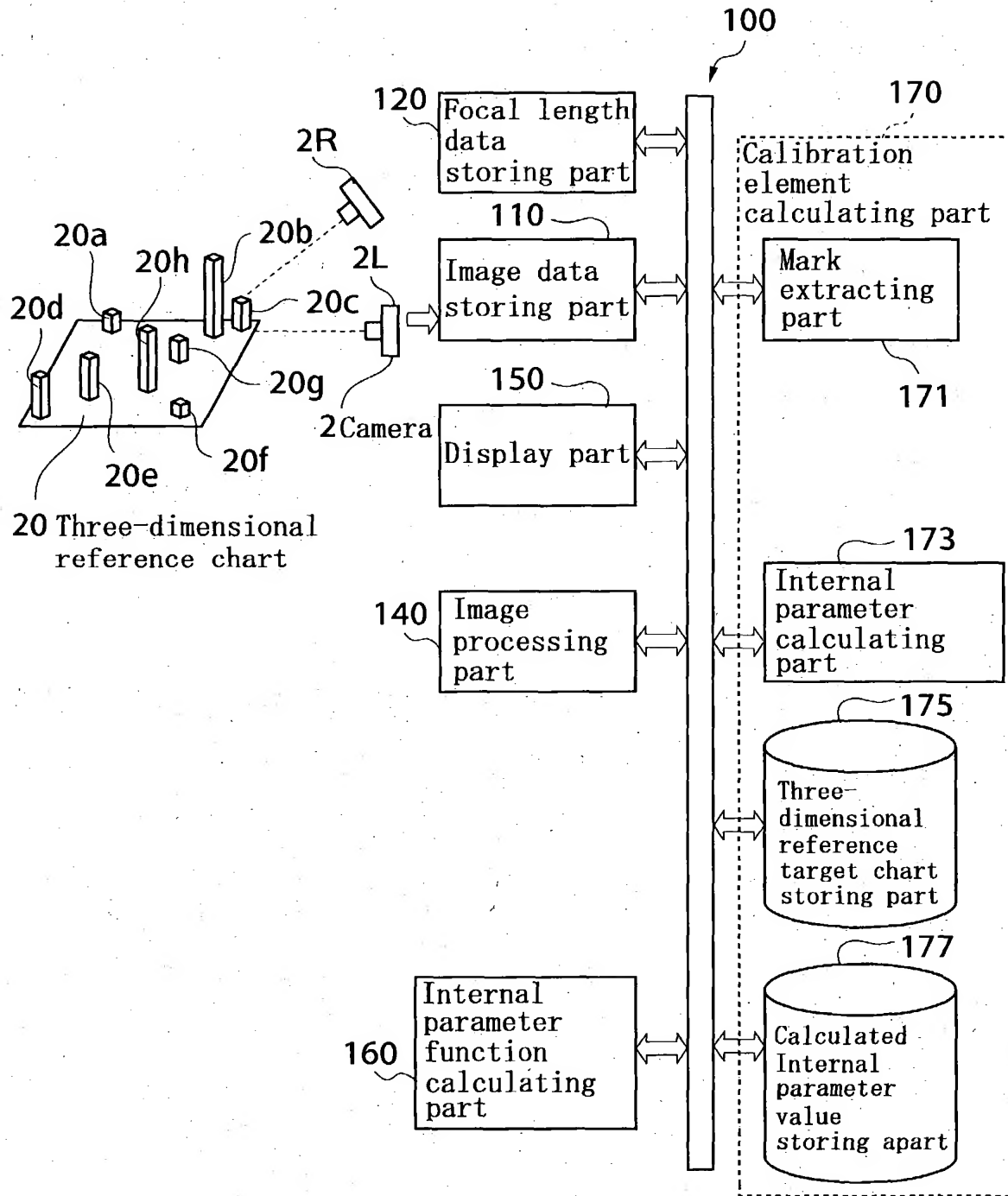


FIG. 13(D)

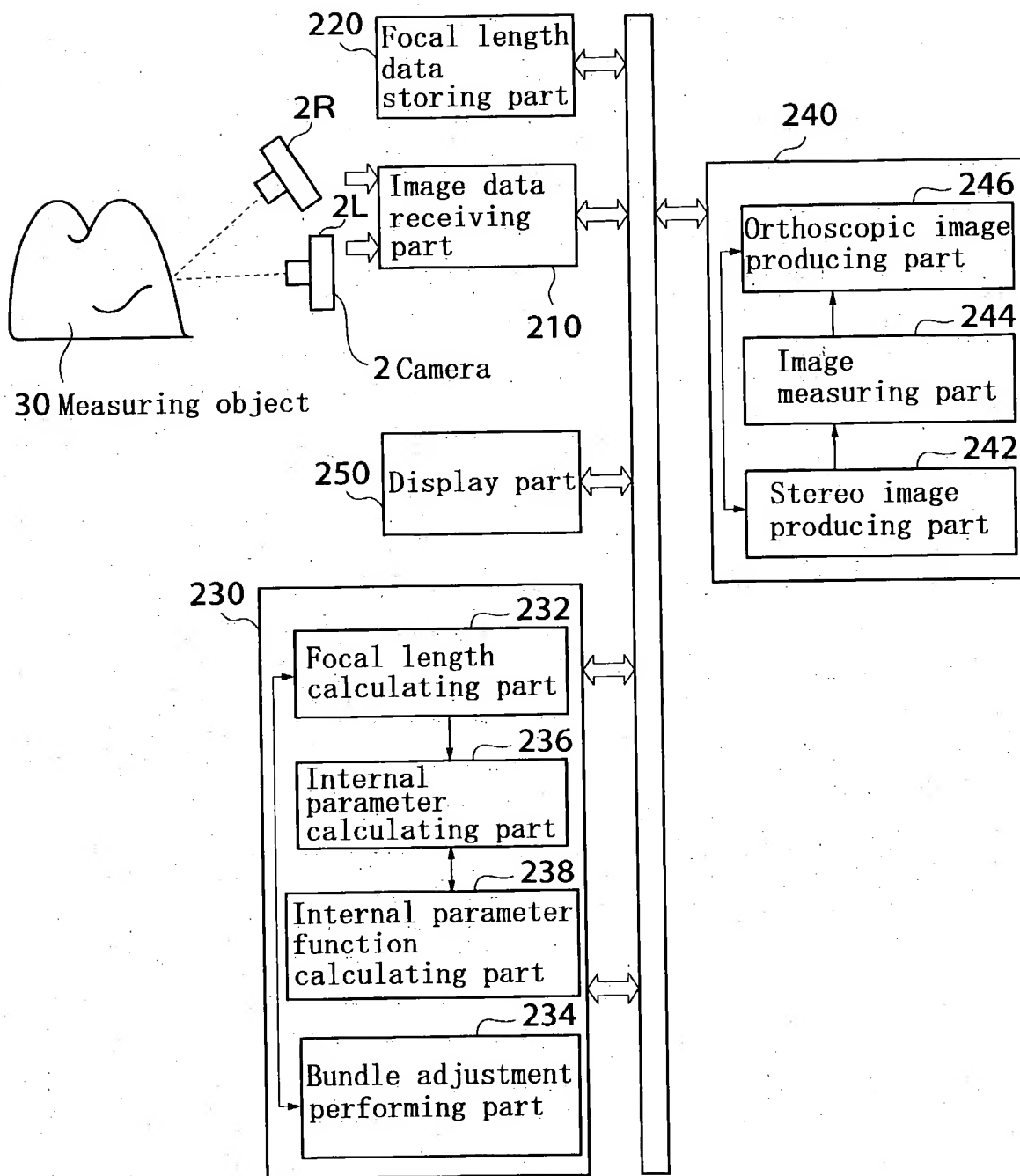
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FIG. 14



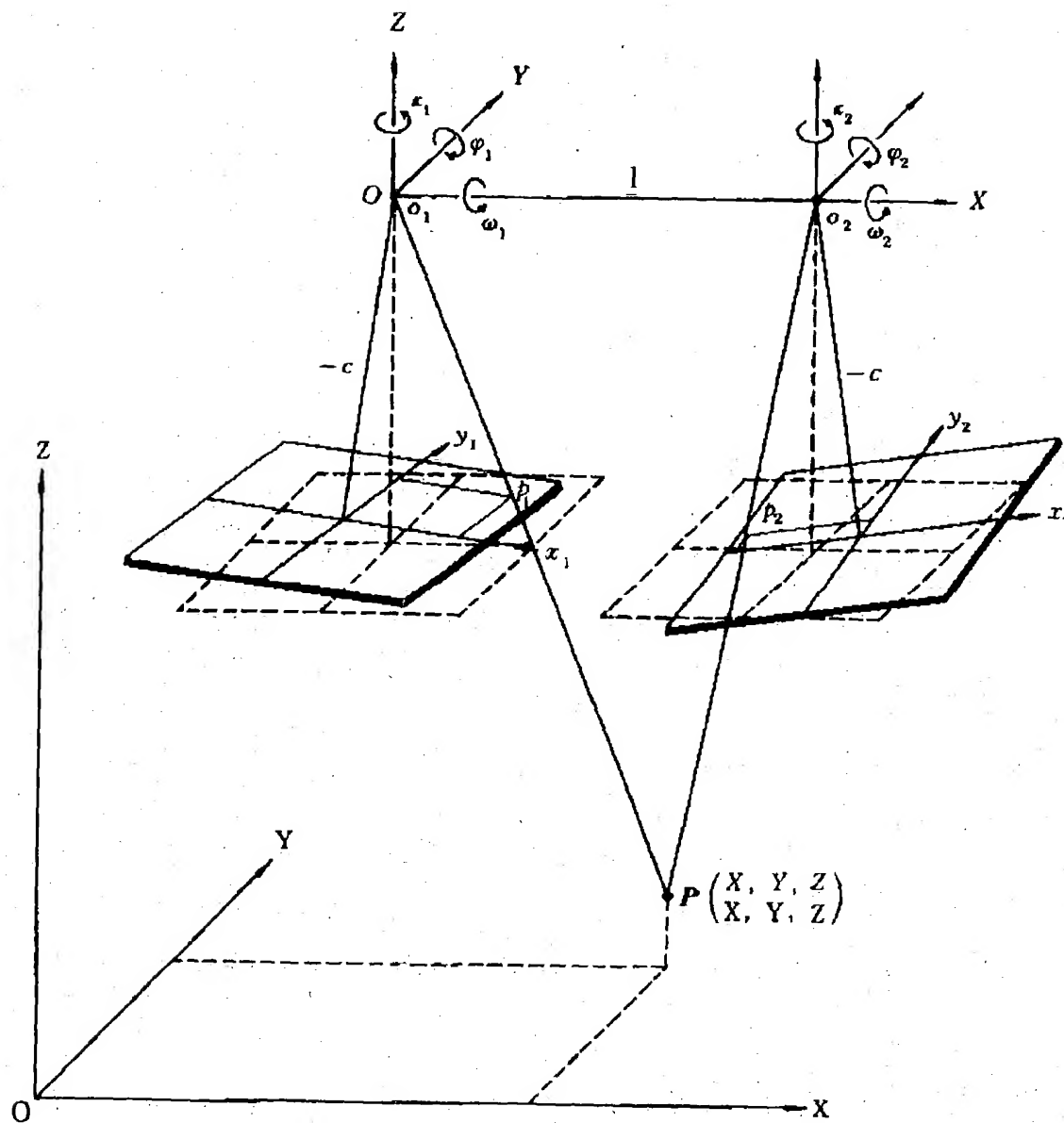
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FIG. 15



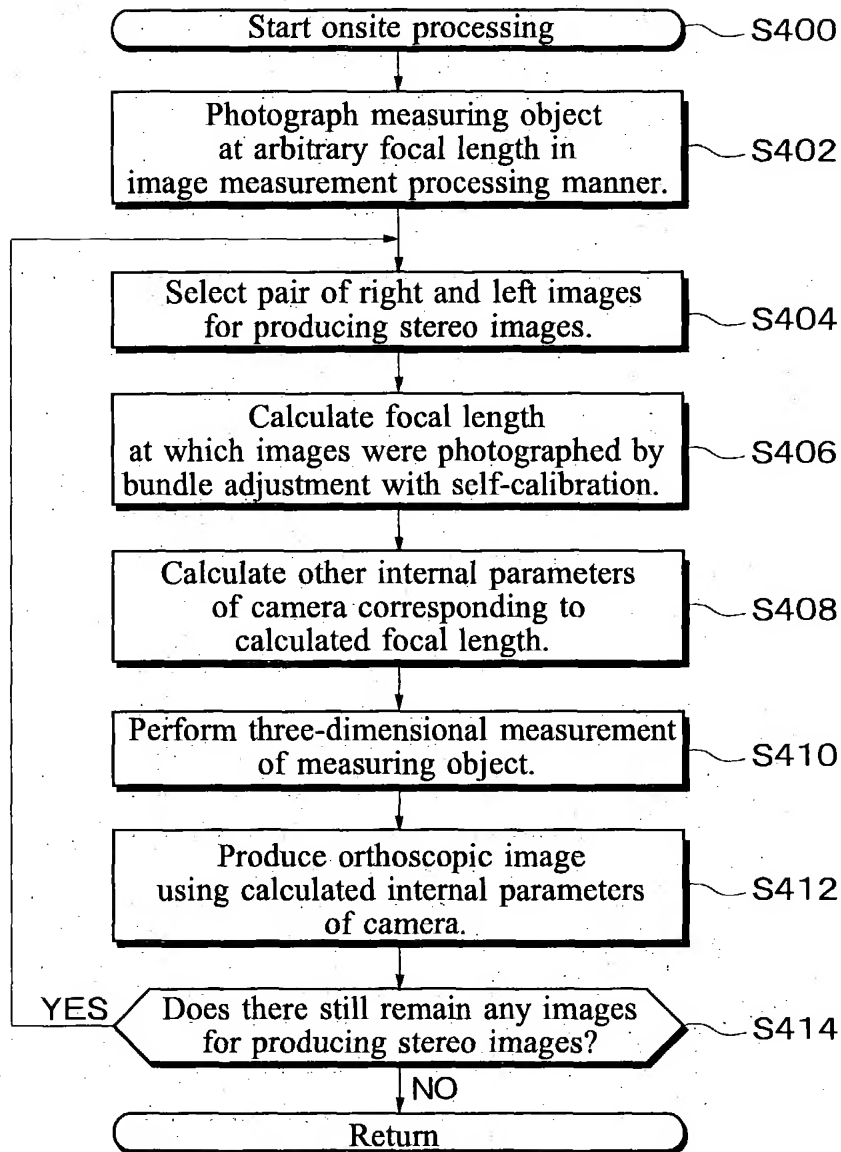
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FIG. 16



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FIG.17



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FIG. 18

Control point



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FIG.19

Photographing and analyzing conditions (unit: mm)

	Focal length (approximate value)	Object distance H	Photographing baseline length B
Case 1: Relatively wide	9	2586	774
Case 2: Intermediate	30	6494	1904
Case 3: Relatively telephoto	42	7516	1706

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FIG.20

Results of Experiment for Measurement Accuracy

Pattern Focal length	Focal length (analysis value) [mm]	Vertical parallax at mutual localization [um]	Plane accuracy [mm]	Depth accuracy [mm]	σ_{xy} [mm]	σ_z [mm]
Case 1: Relatively wide (Without correction)	8. 8 3	1. 5 (8. 8)	0. 7 (8. 4)	1. 4 (13. 5)	1. 0	3. 3
Case 2: Intermediate, approx. (Without correction)	30. 0 4	0. 8 (6. 7)	1. 3 (9. 6)	1. 8 (15. 2)	0. 7	2. 5
Case 3: Relatively telephoto (Without correction)	43. 2 1	1. 5 (6. 8)	1. 4 (11. 3)	1. 9 (18. 8)	0. 6	2. 6